

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Fufang Zha et al.
Serial No: 10/572,893
Confirmation No: 2949
Filed: March 20, 2006
For: METHOD OF CLEANING MEMBRANE MODULES
Examiner: Menon, Krishnan S.
Art Unit: 1797

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Commissioner for Patents

APPELLANT'S REPLY BRIEF PURSUANT TO 37 C.F.R. § 41.41(a)(1)

Dear Sir:

This Reply Brief is submitted in response to the Examiner's Answer mailed June 3, 2010 in the above-referenced application.

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I. Reply Brief Identification

Appellant: Fufang Zha et al.
U.S. Serial No.: 10/572,893
Filing Date: March 20, 2006
Title: METHOD OF CLEANING MEMBRANE MODULES
Examiner: Menon, Krishnan S.
Art Unit: 1797
Title of the Paper: Reply Brief

II. STATUS OF CLAIMS (37 C.F.R. § 41.37(c)(1)(iii))

Claims 1-23 were pending in the application as filed on March 20, 2006. Claims 1, 4, 8, 9, 12, 16, 21, and 23 were amended in a Preliminary Amendment filed March 20, 2006. Claims 1 and 4-12 were amended, claims 24-29 were added, claims 13-18 were withdrawn, and claims 2, 3, and 19-23 were canceled in an Amendment filed on February 23, 2009. In an Amendment filed on May 4, 2009, claims 1, 4-6, 9, 10, 25, and 28 were amended and claims 12 and 29 were canceled. Claims 1, 4-11, and 24-28 currently stand rejected, with claims 1, 4, and 10 being in independent form. Claims 1, 4-11, and 24-28 are being appealed herein.

III. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL
(37 C.F.R. § 41.37(c)(1)(vi))

Whether each of claims 1, 4-11, and 24-28 is unpatentable over the combination of U.S. Patent No. 5,403,479 to Smith et al. (hereinafter “Smith”) and/or U.S. Patent No. 5,209,852 to Sunaoka et al. (hereinafter “Sunaoka”) and/or U.S. Patent No. 5,643,455 to Kopp et al. (hereinafter “Kopp”) and/or U.S. Patent Publication No. 2001/0052494 to Cote et al. (hereinafter “Cote”) and/or JP 11076769 (hereinafter “JP ‘769”).

IV. ARGUMENT (37 C.F.R. § 41.37(c)(1)(vii))

For the reasons provided below, the Examiner's rejections are improper and should be reversed. Each of claims 1, 4-11, and 24-28, as presented, is allowable.

A. There is no *prima facie* case of obviousness of claims 1, 4-11, and 24-28 over the combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769.**1. The Examiner improperly dismisses the objective evidence provided in the Zha Declaration demonstrating that one of ordinary skill in the art would not have been motivated to have made the combinations of references asserted by the Examiner.**

As explained in Applicants' Appeal Brief (the "Appeal Brief"), the declaration of Dr. Fufang Zha, filed November 12, 2009 (the "Zha Declaration") provides evidence that one of ordinary skill in the art would have been dissuaded from combining the teachings of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769 in the manner asserted by the Examiner to render any of the methods claimed in the present application obvious. The reasons set forth in the Zha declaration why one of ordinary skill in the art would not have been so motivated are set forth in detail in the Appeal Brief and will not be repeated here.

In the Examiner's Answer at page 12, the Examiner summarily dismisses the Zha declaration as "only his opinions." As explained in the Appeal Brief, this constitutes clear error by the Examiner. The Examiner does not question Dr. Zha's qualifications as one of ordinary skill in the art of membrane filtration technology. Dr. Zha makes numerous statements of fact that he, as one of ordinary skill in the art, would not have been motivated to have made the combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP '769 asserted by the Examiner. The Examiner however, continues to assert his own alleged reasons, set forth in the previously presented Office Actions, which are contradicted by the statements made in the Zha Declaration, as to why one of ordinary skill in the art would have been motivated to have combined the cited references in the manner asserted. This is improper as a matter of law. In re Sullivan, 498 F.3d 1345, 1351 (Fed. Cir. 2007) (vacating a decision of the BPAI for failing to consider rebuttal evidence presented in expert declarations); In re Soni, 54 F.3d 746, 750 (Fed.

Cir. 1995) (all evidence of nonobviousness must be considered when assessing patentability); In re Zeidler, 682 F.2d 961, 967 (CCPA 1982) (The Patent Office cannot substitute its own judgment for that of an established expert in the art); In re Keller, Terry, and Davies, 642 F.2d 413, 425 (CCPA 1981)¹; Ex parte Malone, No. 2009-003894 (BPAI August 27, 2009)²; Ex Parte Kabeya, No. 2007-2421, (BPAI Sept. 20, 2007) (non-precedential) (reversing the rejections of the Examiner on appeal for failure to credit the declarations of two persons of skill in the relevant art.); MPEP § 716.01 (Evidence traversing rejections, when timely presented, must be considered by the Examiner whenever present.)

Further, even if the statements made in the Zha Declaration could be considered opinion rather than fact, the Examiner is still required to consider them and give them appropriate weight. “Although factual evidence is preferable to opinion testimony, such testimony is entitled to consideration and some weight so long as the opinion is not on the ultimate legal conclusion at issue. While an opinion as to a legal conclusion is not entitled to any weight, the underlying basis for the opinion may be persuasive. In re Chilowsky, 306 F.2d 908, 134 USPQ 515 (CCPA 1962) (expert opinion that an application meets the requirements of 35 U.S.C. 112 is not entitled to any weight; however, facts supporting a basis for deciding that the specification complies with 35 U.S.C. 112 are entitled to some weight); In re Lindell, 385 F.2d 453, 155 USPQ 521 (CCPA 1967) (Although an affiant’s or declarant’s opinion on the ultimate legal issue is not evidence in the case, ‘some weight ought to be given to a persuasively supported statement of one skilled in the art on what was not obvious to him.’ 385 F.2d at 456, 155 USPQ at 524 (emphasis in original)).” MPEP § 716.01(c).

¹ “[T]he PTO must give full consideration to that evidence [presented in an affidavit] and render a decision based on the relative strength of appellant’s showing and the prima facie case established by the references.”

² “Whether the claimed invention would have been obvious cannot be determined without considering evidence attempting to rebut the prima facie case. Manifestly, the Examiner’s consideration and treatment of the ...declaration is improper, since the Examiner has not reweighed the entire merits of the matter. Rather, he has dismissed the evidence of nonobviousness in a cursory manner. Since the Examiner did not properly consider the submitted evidence, the rejection cannot be sustained.”

2. The Examiner improperly overlooks portions of the Zha Declaration establishing the non-operability of the asserted combination.

The Examiner asserts on page 25 of the Examiner's Answer that Applicants' arguments presented in the Appeal Brief at page 9 that the asserted combination would render the apparatus disclosed in Smith, Cote, and JP '769 inoperable has no merit "because no objective reasoning is provided as to why these apparatuses would have become incapable or inoperable." The Examiner appears to have totally ignored paragraphs 12, 13, 23, and 27 of the Zha Declaration in which this reasoning is provided. For example, in paragraph 12 of the Zha Declaration Dr. Zha explains that modifying the apparatus disclosed in Smith to provide for directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module as recited in claims 1 and 4 of the present application would render the device of Smith incapable of performing according to the method disclosed in Smith because "check valve 26 [of Smith] is necessary to enable cleaning of the membrane lumens by circulating a biocidal liquid through them. This check valve prevents biocide (or liquid permeate) from being applied to both ends of the membrane fibers – liquid could not be directed into the membrane fibers through the downstream header 11'. As such, the device of Smith could not perform an act of directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module. Removing the check valve 26 such that the device of Smith could perform this act would render the device incapable of circulating biocidal solution through the lumens of the fibers and returning it to the storage tank 27 as disclosed in Smith."

In paragraph 13 of the Zha Declaration Dr. Zha explains that modifying the apparatus or method disclosed in Smith to provide for applying a gas to the membranes which did not penetrate into the membrane pores as recited in claims 1, 4, and 10 of the present application would render the apparatus of Smith inoperable because in the method of Smith a biocidal gas must pass through the pores of the membrane and chemically react with foulant on the outside of the membranes to remove it.

In paragraph 23 of the Zha Declaration Dr. Zha explains that modifying the apparatus of Cote to provide for isolating the lumens of the membranes, the manifold, and a portion of piping through which permeate is withdrawn during filtration as recited in claims 1 and 4 of the present

application would have made it impossible to deliver permeate from the permeate storage tank through the permeate pump, backwash valve, and associated piping to effect backwash as disclosed in Cote.

In paragraph 27 of the Zha Declaration Dr. Zha explains that modifying the system of JP '769 such that it was capable of performing a method including isolating the lumens of the membranes, the manifold, and a portion of piping though which permeate is withdrawn during filtration when the filtration process is stopped as recited in claims 1 and 4 of the present application would have made it impossible for the apparatus of JP '769 to deliver permeate from the permeate tank 13 through the pump 15 to backwash the membranes as disclosed.

Accordingly, “objective reasoning . . . as to why these apparatuses [of Smith, Cote, and JP '769] would have become incapable or inoperable” if modified as asserted by the Examiner has been provided, and the Examiner has impermissibly ignored said reasoning. In re Sullivan, 498 F.3d at 1351; In re Soni, 54 F.3d at 750; In re Keller, Terry, and Davies, 642 F.2d at 425; Ex parte Malone, No. 2009-003894 (BPAI August 27, 2009); Ex Parte Kabeya, No. 2007-2421, (BPAI Sept. 20, 2007); MPEP § 716.01.

3. The Examiner mischaracterizes the Zha Declaration by taking portions out of context to support his conclusions.

The Examiner asserts at page 25 of the Examiner’s Answer that Dr. Zha ignores teachings of the references, giving the example that “[c]ontrary to what is argued by Dr. Zha, Cote teaches isolating the lumen, the manifold, and portions of piping after the filtration process is stopped.” This, however, is not what Dr. Zha asserts in the Zha Declaration. What Dr. Zha asserts is that Cote fails to disclose “isolating the lumens of the membranes, the manifold, and a portion of piping though which permeate is withdrawn during filtration when the filtration process is stopped.” (Zha Declaration at paragraph 21, emphasis added.) Cote indeed fails to teach this claim element, as further described below.

The Examiner attacks the reasoning presented in the Zha Declaration by asserting on page 25 of the Examiner’s Answer that “Dr. Zha assumes bodily incorporation of the references on one another.” In contrast to the Examiner’s assertion, however, Dr. Zha does not “assume[] bodily incorporation of the references on one another” in the Zha Declaration. Rather, Dr. Zha

explains why one of ordinary skill in the art would have been dissuaded from modifying the various references such that they were capable of performing the acts which the Examiner asserts could be performed by an apparatus formed from the alleged combination of the references. (See, e.g. the Zha Declaration at paragraph 10 “As one of ordinary skill in the art, I would not have been motivated to have modified the apparatus disclosed in Smith to provide for gas scouring of surfaces of the membranes”; at paragraph 12 “As one of ordinary skill in the art, I would not have been motivated to have modified the apparatus disclosed in Smith to provide for directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module”; at paragraph 16 “as one of ordinary skill in the art, I would not have been motivated to have modified the system of Sunaoka such that it was capable of performing a method including supplying a gas into membrane fibers at a pressure less than a bubble point of the membranes such that the gas did not penetrate the membrane pores”; and at paragraph 20 “As one of ordinary skill in the art, I would not have been motivated to have modified the system of Kopp to provide for directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module.”)

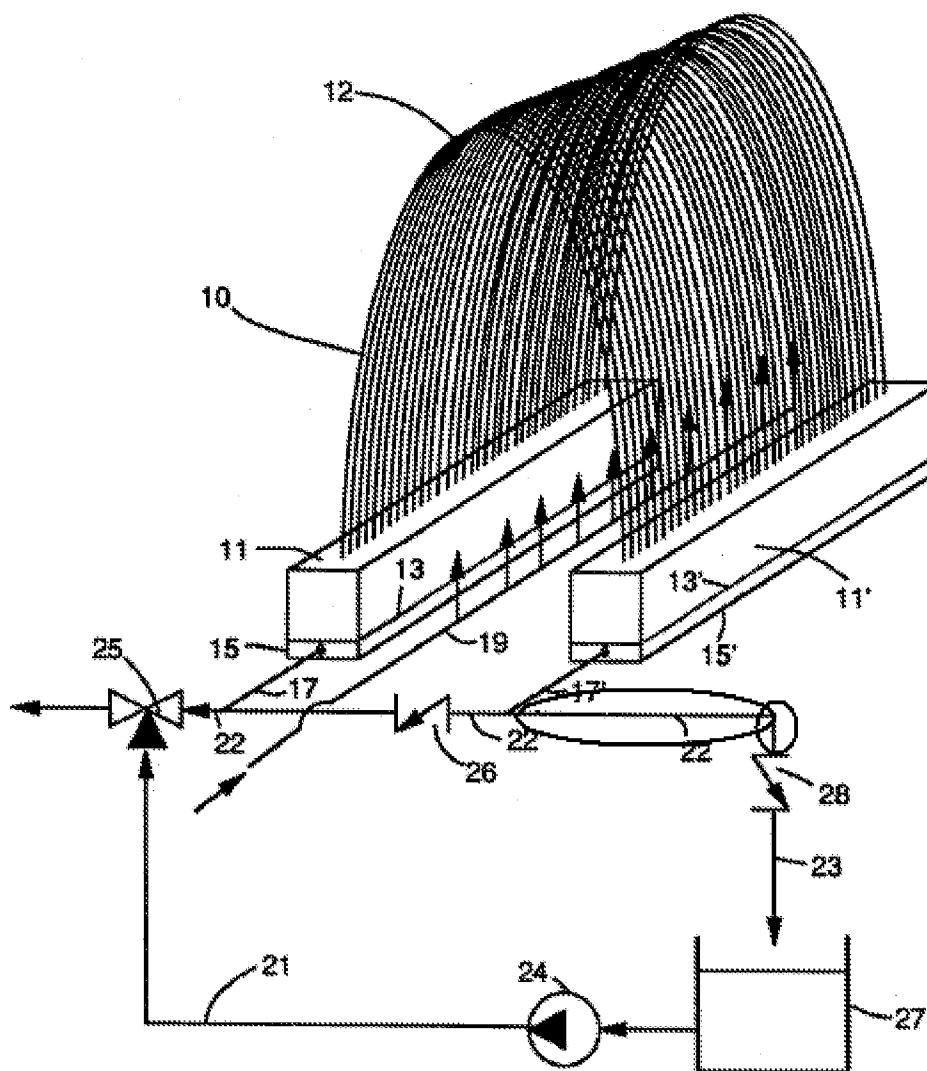
In conclusion, the Examiner has committed clear error in summarily dismissing the Zha Declaration which establishes that one of ordinary skill in the art would not have been motivated to have combined the cited references in the manner asserted by the Examiner and by ignoring and/or mischaracterizing portions thereof.

4. Even if the asserted combinations of references were valid, the combinations still fail to teach each element of the present claims.

i. All elements of independent claims 1 and 4 are not found in the asserted combination of references.

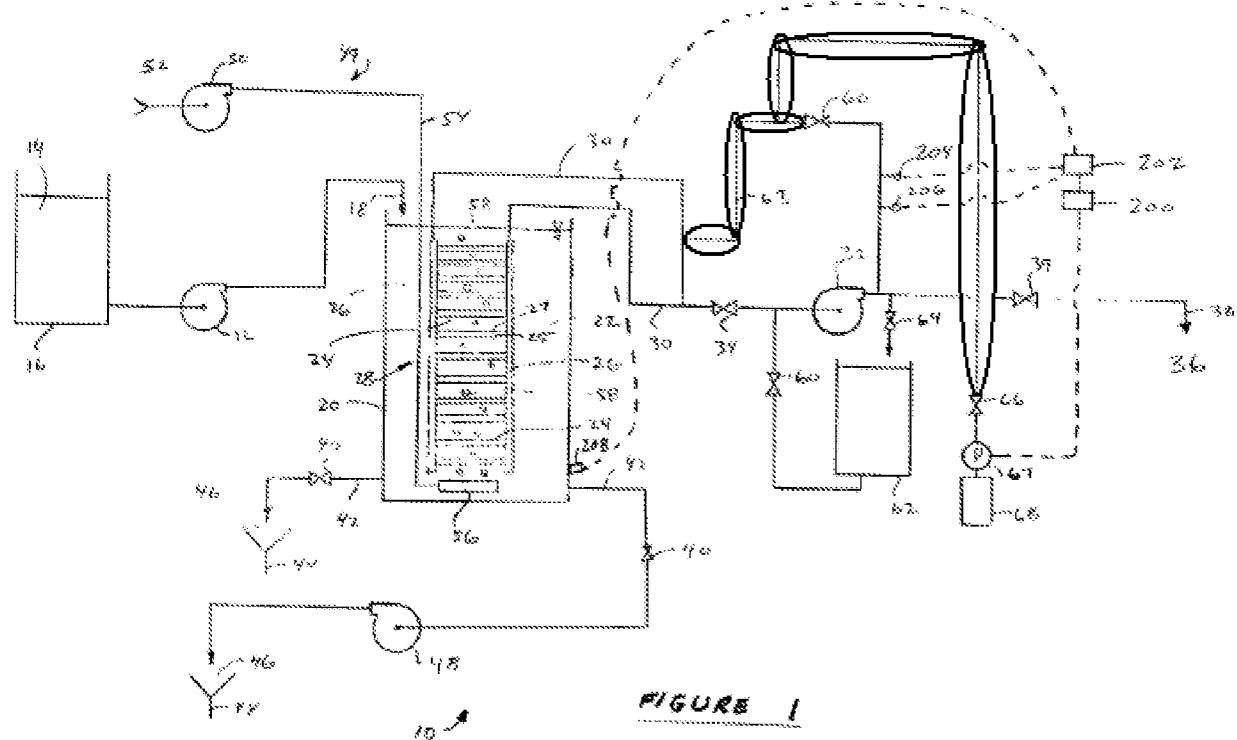
Even if the cited references could have been validly combined in the manner asserted by the Examiner, all elements of the claims of the present application still would not be found in the asserted combination. For example, the act recited in claim 1 of “isolating the lumens of the

membranes, the manifold, the portion of the piping, and a gas inlet when the filtration process is stopped, the lumens of the membranes, the manifold, and the portion of piping upstream of the valve during filtration, wherein the lumens of the membranes, the manifold, and the portion of piping consist of those through which permeate is withdrawn while filtering the feed liquid” is not found in any of the cited references. The Examiner states on page 5 of the Examiner’s Answer that in the method of Smith “[i]solating the membrane from the filtrate collection area is implied.” Even if such an act was implied in Smith, however, this is not what is recited in independent claims 1 or 4 of the present application. Rather, each of these claims recite an act of isolating lumens of filtration membranes, a manifold, and a portion of piping upstream of the valve during filtration, wherein the lumens of the membranes, the manifold, and the portion of piping consist of those through which permeate is withdrawn while filtering the feed liquid. In the below diagram (reproduced from FIG. 2 of Smith), the circled areas of piping are neither ones “through which permeate is withdrawn while filtering the feed liquid” nor ones which are isolated from “the lumens of the membranes, the manifold, and the portion of piping consist[ing] of those through which permeate is withdrawn while filtering the feed liquid” when the filtration process is stopped.

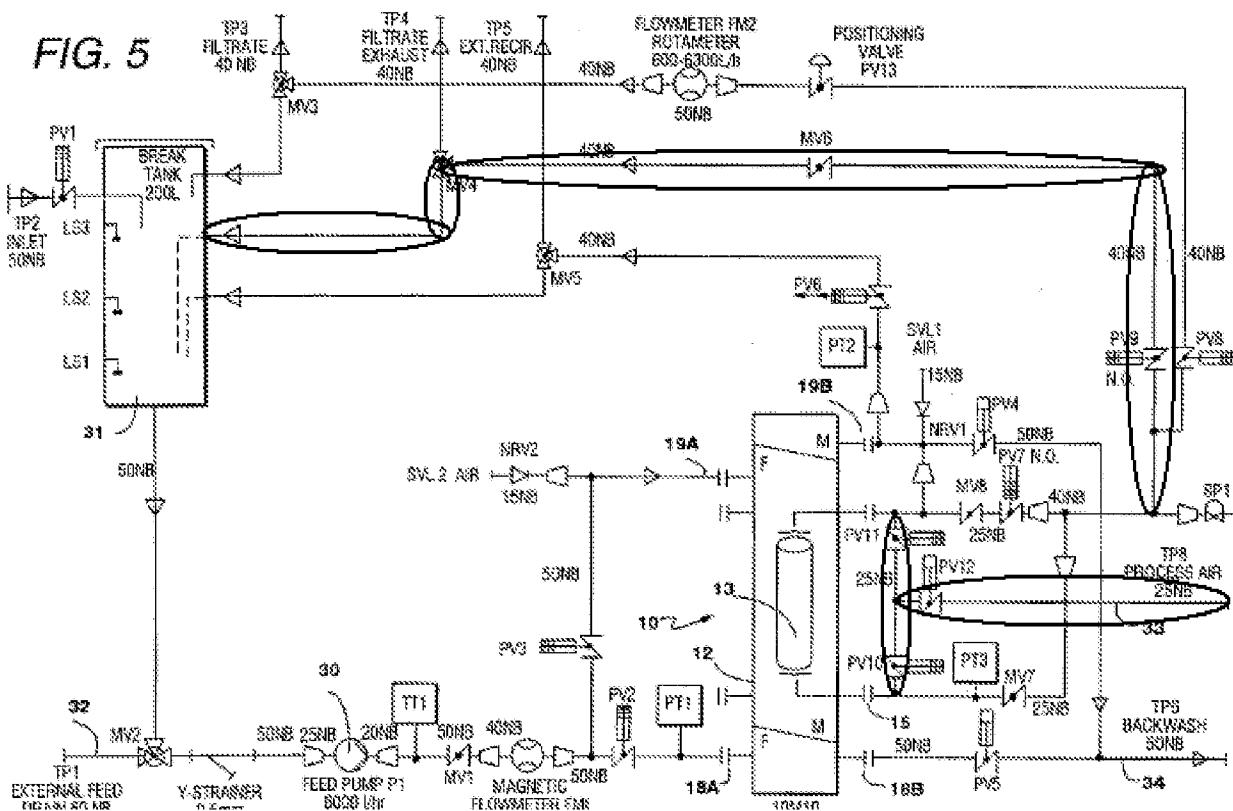


The Examiner asserts on pages 18 and 25 of the Examiner's Answer that Cote also teaches a step of "isolating the lumen, the manifold, and portions of the piping after the filtration process is stopped" by the operation of permeate valve 34. Again, this is not what is recited in independent claims 1 or 4 of the present application as set forth above. Nor does Cote disclose an act of isolating lumens of filtration membranes, a manifold, and a portion of piping upstream of the valve during filtration, wherein the lumens of the membranes, the manifold, and the portion of piping consist of those through which permeate is withdrawn while filtering the feed liquid as recited in independent claims 1 and 4. In the below diagram (reproduced from FIG. 1 of Cote), the circled areas of piping are not isolated from "the lumens of the membranes, the manifold, and the portion of piping consist[ing] of those through which permeate is

withdrawn while filtering the feed liquid" when the filtration process is stopped, nor do they consist of piping "through which permeate is withdrawn while filtering the feed liquid."



On page 27 of the Examiner's Answer the Examiner asserts that Kopp at FIG. 5 also discloses an act of "isolating the lumens of the membranes, the manifold, the portion of the piping, and a gas inlet when the filtration process is stopped, the lumens of the membranes, the manifold, and the portion of piping upstream of the valve during filtration, wherein the lumens of the membranes, the manifold, and the portion of piping consist of those through which permeate is withdrawn while filtering the feed liquid." This, however, is a mischaracterization of Kopp. Fig. 5 of Kopp is reproduced below, with areas of piping circled which are not isolated from "the lumens of the membranes, the manifold, and the portion of piping consist[ing] of those through which permeate is withdrawn while filtering the feed liquid" when the filtration process is stopped, nor which consist of piping "through which permeate is withdrawn while filtering the feed liquid."

FIG. 5

The “isolating” step recited in independent claims 1 and 4 cannot be “an engineering detail required for the filtration process plant” as asserted by the Examiner on page 27 of the Examiner’s Answer, as such an act is not performed by the apparatus in any of the cited references.

The Examiner also asserts on page 5 of the Examiner’s Answer that the “isolating” act of independent claims 1 and 4 “is . . . not a critical step in the process.” The Examiner seems to be disregarding the rule that to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *Fresenius USA, Inc. v. Baxter Int'l, Inc.*, 582 F.3d 1288 (Fed. Cir. 2009); *In re Royka*, 490 F.2d 981 (CCPA 1974). “All words in a claim must be considered in judging the patentability of that claim against the prior art.” MPEP at § 2143.03.

In the Examiner’s Answer at page 6, the Examiner asserts that “the specific details of the lines and manifolds to be included in the backwash is also not patentable – these are only details of implementing the process step in a specific system.” The “isolating” act recited in claims 1 and 4 is however, more than “only details of implementing the process step.” This act defines

the portion of permeate that is used in the backwashing act of the claimed invention. The use of the portion of permeate thus defined for backwashing results in advantages of reducing the amount of wasted permeate, thus reducing the operating costs of the membrane filtration system. As such, the “the specific details of the lines and manifolds to be included in the backwash” is certainly a patentable element of the claims of the present application. “Merely saying that an invention is a logical, commonsense solution to a known problem does not make it so.” Trimed, Inc. v. Stryker Corp., No. 2009-1423 (Fed. Cir. June 9, 2010).

Further, the act recited in claim 1 of “venting the second gas from the isolated lumens, manifold, and portion of piping” is not found in any of the cited references. The Examiner asserts on pages 11 and 27 of the Examiner’s Answer that “[t]he additional step of venting the gases remaining in the lumen is also implied, since such gas remaining in the lumen will be vented out through the filtrate flow when normal filtration is resumed.” The Examiner does not, however, address venting of gas from the isolated manifold and portion of piping as recited in this act of claim 1.

ii. **All elements of independent claim 10 are not found in the asserted combination of references.**

In the Examiner’s Answer at page 9 and 10, the Examiner asserts that JP ‘769 anticipates claim 10 of the present application because JP ‘769 teaches applying gas pressure below the bubble point during the cleaning of the membranes. What the Examiner fails to appreciate, however, is that the chemical cleaning step of JP’ 769 in which a gas below the bubble point is allegedly applied to the cleaning solution takes place in a chemical washing device 20 separate from the system used during filtration (FIG. 2 and paragraph [0022] of JP ‘769). Further, in the filtration system (FIG. 1 of JP ‘769) any backwashing of the membranes that would occur would utilize fluid from the tank 13 pumped through pump 15. Tank 13 is not a shell side of a pressure vessel of the membrane filtration system as recited in independent claim 10. Thus, in JP ‘ 769, there is no disclosure or suggestion of an act of “applying a gas at a pressure below a bubble point of the filtration membranes to liquid permeate remaining within the shell side of the pressure vessel, the liquid permeate remaining within the shell side of the pressure vessel consisting of the liquid permeate formed on the shell side of the pressure vessel, to displace at

least some of the liquid permeate through the filtration membrane pores in a direction opposite to that of filtration, the gas not penetrating into the membrane pores” as recited in independent claim 10.

On page 11 of the Examiner’s Answer, the Examiner relies on Bartels et al. (US 2003/0150807, hereinafter “Bartels”) as teaching “inside out” operation, however, Bartels does nothing to cure the failure of any of the other cited references to disclose or suggest each element of independent claim 10. Notably, in Bartels, in both the “bottom backwashing” and the “top backwashing” acts disclosed, backwashing fluid is introduced to the disclosed pressure vessel from a top feed line (see Bartels FIGS. 5 and 7 and the descriptions thereof). The backwashing fluid is not “displace[d] . . . through the filtration membrane pores” by “applying a gas at a pressure below a bubble point of the filtration membranes to liquid permeate remaining within the shell side of the pressure vessel” as claimed in independent claim 10.

No *prima facie* case of obviousness of the claims of the present application has been established because the Examiner has not established a valid rationale as to why one of ordinary skill in the art would have been motivated to have made the asserted combination of references, and indeed, ignores evidence provided in the Zha Declaration establishing that one of ordinary skill in the art would not have been so motivated. Further, even if the cited references could have been validly combined, the asserted combination still fails to teach all elements of the claims of the present application. As no *prima facie* case of obviousness has been established, all claims are patentable over the combination of Smith and/or Sunaoka and/or Kopp and/or Cote and/or JP ‘769 asserted by the Examiner.

B. The Examiner fails to give proper credit to the secondary indicia of non-obviousness presented in the Biltoft Declaration.

Even if a *prima facie* case of obviousness of any of claims 1, 4-11, and 24-28 were to have been established, this *prima facie* case would be overcome by secondary indicia of non-obviousness of the subject matter of these claims.

Evidence of commercial success of products operating in accordance with the claimed subject matter, provided in the Declaration of Bruce Biltoft, filed November 12, 2009

(hereinafter the “Biltoft Declaration”), attached as an appendix to the Appeal Brief, demonstrate that the subject matter claimed in the present application cannot be obvious.

The subject matter of the Biltoft Declaration and the manner in which the evidence provided therein established that the claimed invention could not have been obvious due to the tremendous commercial success of products operating in accordance with the claimed methods was described in the Appeal Brief and will not be repeated in detail here.

The Examiner asserts on page 12 of the Examiner’s Answer that the commercial success of products operating in accordance with the claimed invention has not been linked to the claimed invention. Applicants respectfully disagree. As explained in Applicants’ Appeal Brief, the Biltoft Declaration establishes that membrane filtration systems operating in accordance with the claimed methods display a plurality of improvements in terms of, for example, reduced capital and operating costs, increased operating efficiency, and reduced waste which have been touted by marketing teams and have directly resulted in the increase in sales and market share for such systems. (See the Biltoft Declaration at paragraph 12.) “Commercial success or other secondary considerations may presumptively be attributed to the patented invention . . . where ‘the marketed product embodies the claimed features, and is coextensive with them.’”

Muniauction, Inc. v. Thomson Corp., 532 F.3d 1318, 1328 (Fed. Cir. 2008) (citing Ormco Corp. v. Align Tech., Inc., 463 F.3d 1299, 1311-12 (Fed. Cir. 2006) and quoting Brown & Williamson Tobacco Corp. v. Philip Morris, Inc., 229 F.3d 1120, 1130 (Fed. Cir. 2000)); “[W]hen a patentee can demonstrate commercial success, usually shown by significant sales in a relevant market, and that the successful product is the invention disclosed and claimed in the patent, it is presumed that the commercial success is due to the patented invention. . . . If a patentee makes the requisite showing of nexus between commercial success and the patented invention, the burden shifts to the challenger to prove that the commercial success is instead due to other factors extraneous to the patented invention, such as advertising or superior workmanship.” J.T. Eaton & Co. v. Atlantic Paste & Glue Co., 106 F.3d 1563, 1571 (Fed. Cir. 1997). The Examiner has not presented any evidence or any convincing line of reasoning to overcome the presumption that the commercial success of the products operating in accordance with the claimed methods described in the Biltoft Declaration has resulted from operating in accordance with the claimed methods.

The Examiner asserts on page 12 of the Examiner's Answer that the commercial success achieved by products operating in accordance with the claims of the present application cannot be linked to the claimed methods because systems such as that described in the Smith reference could also achieve backwashes which were quick and efficient. The Examiner also asserts on page 28 of the Examiner's Answer that JP '769 and Cote also teach methods of operating membrane filtration systems which result in reduced cost, waste, or operating time. The Examiner fails to show, however, that the systems of Smith, JP '769, or Cote, alone or in combination, could have achieved either the magnitude of any one of the improvements, let alone the combination of improvements displayed by systems operating in accordance with the claimed methods, e.g., a 5% reduction in capital cost,³ a 5% reduction in backwash time,⁴ a 1% increase in operating efficiency,⁵ a 20% reduction in backwash waste,⁶ and a decrease in operating cost⁷. The Examiner's assertion that Smith, JP '769, and Cote teach methods which could have achieved some of the same types of advantages as do systems operating in accordance with the presently claimed invention is thus irrelevant to the question of whether nexus between the methods claimed in the present application and the commercial success of systems operating in accordance with these methods has been established.

Indeed, nexus between at least the method claimed in independent claim 1 of the present application and the commercial success of systems operating in accordance with this method has been conclusively established. Nexus has been established in the Biltoft Declaration between the advantages attained by this method and the increase in sales of systems incorporating this method due to these advantages once such systems were introduced versus other systems not operating in accordance with this claimed method.

Further, all of JP '769, Cote, and Smith were known at the time of the present invention. As explained in the Biltoft Declaration (e.g., at paragraph 4), the presently claimed invention provides for improvements in terms of, for example, reduced capital and operating costs,

³ Biltoft Declaration at paragraph 5.

⁴ Biltoft Declaration at paragraph 6.

⁵ *Id.*

⁶ Biltoft Declaration at paragraph 7.

⁷ Biltoft Declaration at paragraphs 8 and 9.

increased operating efficiency, and reduced waste versus previously known technologies, which presumably includes the technologies disclosed in JP '769, Cote, and Smith.

The Examiner further asserts on page 28 of the Examiner's Answer that the increase in efficiency, reduced waste, reduced capital cost, and operating costs cannot be considered unexpected because the improvements could be gleaned from the teachings of the cited references by one of ordinary skill and simply involve "reverting to older known method steps." This of course begs the question that if it was so obvious for one of ordinary skill in the art to use "older known process steps" to achieve the advantages of products operating in accordance with the presently claimed methods which are superior to previous products and have won the increase in sales and market share described in the Biltoft Declaration, why were such methods and systems not developed before? Again, the Examiner is setting forth his own opinions and conclusions as to the obviousness of the presently claimed invention and impermissibly asserts that they should be given greater weight than the contradictory evidence of commercial success of products embodying the present invention set forth in the Biltoft Declaration.

C. Summary

The evidence presented in the Zha and Biltoft Declarations show that the presently claimed invention cannot have been obvious over the references cited by the Examiner. The Examiner improperly dismisses, ignores, and/or mischaracterizes the evidence presented in these declarations and asserts that his own opinion as to the obviousness of the presently claimed invention should somehow carry more weight than evidence provided in declarations of persons who have been established as having ordinary skill in the applicable art. This, and the Examiner also fails to recognize that the asserted combination of references fails to disclose or suggest each element recited in the claims of the present application.

In view of the above, each of the rejections is improper and should be reversed. Applicants respectfully requests reversal of the rejections and issuance of a Notice of Allowance.

V. CLAIMS APPENDIX (37 C.F.R. § 41.37(c)(1)(viii))

1. (Previously Presented) A method of backwashing a membrane filtration system including a vessel, a membrane module, piping, and a manifold comprising:

filtering a feed liquid through pores in walls of membranes of the membrane filtration system to produce a liquid permeate;

withdrawing the permeate from lumens of the membranes and through the manifold, a portion of the piping, and a valve while filtering the feed liquid;

stopping the filtration process;

isolating the lumens of the membranes, the manifold, the portion of the piping, and a gas inlet when the filtration process is stopped, the lumens of the membranes, the manifold, and the portion of piping upstream of the valve during filtration, wherein the lumens of the membranes, the manifold, and the portion of piping consist of those through which permeate is withdrawn while filtering the feed liquid;

scouring surfaces of the membranes by flowing bubbles of a first gas past surfaces of the membranes;

supplying a second gas through a second gas inlet at a pressure less than a bubble point of the membranes;

applying the second gas to a portion of liquid permeate present in the isolated lumens, manifold, and portion of piping by introducing the second gas through the second gas inlet into the filtration system on a side of the valve in direct fluid communication with the membrane module;

directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module;

backwashing the membranes by displacing at least some of the portion of liquid permeate through pores in walls of the membranes, the second gas not penetrating into the membrane pores;

discharging backwash waste from the vessel;

refilling the vessel with feed liquid;

venting the second gas from the isolated lumens, manifold, and portion of piping; and resuming filtration.

2-3. (Canceled)

4. (Previously Presented) A method of filtering solids from a liquid suspension comprising:
 - immersing filtration membranes in the liquid suspension;
 - filtering the liquid suspension through pores in walls of the filtration membranes;
 - producing a liquid permeate within lumens of the filtration membranes;
 - drawing off liquid permeate from the lumens;
 - withdrawing the permeate from the lumens and through a manifold and a valve;
 - periodically suspending the filtration process;
 - isolating the lumens, the manifold, a gas inlet, and a portion of piping when the filtration process is suspended, the lumens, the manifold, and the portion of piping upstream of the valve during filtration, wherein the lumens, the manifold, and the portion of piping consist of those through which permeate is withdrawn;
 - directing liquid permeate present in the isolated manifold and portion of piping into the lumens through a first end of the filtration membranes and through a second end of the filtration membranes; and
 - applying a gas at a pressure below a bubble point of the filtration membranes to the liquid permeate to displace at least some of the liquid permeate through the pores in the walls of the filtration membranes in a direction opposite to that of filtration, the gas not penetrating into the membrane pores.
5. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 4 wherein displacing at least some of the liquid permeate through the pores in the walls of the filtration membranes comprises removing solids from the filtration membranes into the liquid suspension surrounding the filtration membranes.
6. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 5 further comprising reducing the volume of the liquid suspension surrounding the filtration membranes before displacing at least some of the liquid permeate through the pores in the walls of the filtration membranes.

7. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 6 wherein the volume of liquid suspension surrounding the filtration membranes is reduced by suspending provision of the liquid suspension while providing a pressure differential across walls of the filtration membranes and drawing permeate from the filtration membranes.

8. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 5 further comprising removing at least part of the liquid suspension surrounding the filtration membranes containing the removed solids by a sweep, drain-down or by a feed and bleed process to at least partially discharge the liquid suspension surrounding the filtration membranes.

9. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 4 further comprising using permeate remaining in ancillaries such as headers, and piping in addition to that in the filtration membrane lumens and manifold as a source of backwash liquid.

10. (Previously Presented) A method of filtering solids from a liquid suspension comprising:
applying the liquid suspension to lumens of filtration membranes;
filtering the liquid suspension through pores in walls of the filtration membranes;
forming liquid permeate on a shell side of a pressure vessel in which the filtration membranes are mounted;
drawing off liquid permeate from the shell side of the pressure vessel;
periodically suspending the filtration process; and
applying a gas at a pressure below a bubble point of the filtration membranes to liquid permeate remaining within the shell side of the pressure vessel, the liquid permeate remaining within the shell side of the pressure vessel consisting of the liquid permeate formed on the shell side of the pressure vessel, to displace at least some of the liquid permeate through the filtration membrane pores in a direction opposite to that of filtration, the gas not penetrating into the membrane pores.

11. (Previously Presented) The method of filtering solids from a liquid suspension according to claim 4 further comprising increasing the amount of permeate available for backwashing when filtration is suspended by providing a further chamber or reservoir in a permeate flow circuit.

12. (Canceled)

13. (Withdrawn) A filtration system for removing fine solids from a liquid suspension comprising:

- (i) a vessel for containing said liquid suspension;
- (ii) a plurality of permeable, hollow membranes within the vessel;
- (iii) means for providing a pressure differential across walls of said membranes such that some of the liquid suspension passes through the walls of the membranes to be drawn off as permeate;
- (iv) means for withdrawing permeate from the membranes; and
- (v) means for applying gas at a pressure below the bubble point to the liquid permeate within the system and the membrane lumens to affect a discharge of at least some of the liquid permeate in the lumens through the membrane walls to dislodge any solids retained therein and displace the removed solids into the liquid suspension surrounding the membranes.

14. (Withdrawn) A filtration system according to claim 13 wherein said membranes are mounted in a number of membrane modules and the membrane modules are used in a bank and connected to a manifold for distributing liquid suspension to and removing permeate from the system.

15. (Withdrawn) A filtration system according to claim 14 wherein the gas is introduced into the manifold of the bank of modules so that permeate within the manifold is utilized for backwash.

16. (Withdrawn) A filtration system according to claim 13 further including means to reduce the volume of liquid suspension in the vessel before the backwash so as to reduce the backwash waste volume.

17. (Withdrawn) A filtration system according to claim 16 wherein the volume of liquid suspension in the vessel is reduced by suspending flow of feed to the feed vessel while continuing to provide a pressure differential across walls of said membranes and withdrawal of permeate from the membranes.

18. (Withdrawn) A filtration system according to claim 17 wherein the pressure differential across walls of said membranes is obtained by application of a pressurized gas.

19-23. (Canceled)

24. (Previously Presented) The method according to claim 1, wherein the permeate remaining present in the system when the filtration process is stopped consists of permeate present in the system on a side of a valve configured and arranged to isolate the filtration membranes from a second section of piping.

25. (Previously Presented) The method according to claim 1, wherein isolating the membrane lumens, the manifold, and the gas inlet comprises closing the valve, the valve configured and arranged to isolate the membranes from a second section of piping.

26. (Previously Presented) The method according to claim 1, wherein backwashing is performed without the use of a backwash pump or a permeate holding tank.

27. (Previously Presented) The method according to claim 1, wherein the permeate remaining present in the system when the filtration process is stopped consists of at least one of permeate remaining in at least one manifold in fluid communication with at least one membrane module, in at least one membrane module header, in piping associated with the at least one manifold and the at least one membrane module header, and in a permeate side of filtration membranes

28. (Previously Presented) The method according to claim 1, further comprising draining down liquid suspension including the displaced backwashing liquid.

29. (Canceled)

VI. CONCLUSION

For the reasons provided above, the rejections are improper and should be reversed. Appellant respectfully requests reversal of the rejections and issuance of a Notice of Allowance.

If there is any additional fee occasioned by this filing, including an extension fee that is not covered by an accompanying payment, please charge any deficiency to Deposit Account No. 50/2762, Ref. No. M2019-7033US.

+Respectfully submitted,
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